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## 5. Depicting Real-Time Water Quality Data

Now that your water quality monitoring network is in place and you have collected the resulting data, you can turn to the next step in providing your community with timely water quality information: using data visualization tools to graphically depict this information. By using the types of data visualization tools described in this chapter, you can create graphic representations of water quality data that can be used on Web sites, in reports and educational materials, and in other outreach and communication initiatives.

- Section 5.1 provides an overview of data visualization.
- Section 5.2 contains an introduction to the data visualization tools used by the River Index Project Team.

If you are interested in a basic introduction to data visualization, you might only want to read the initial section. If you are responsible for choosing and using data visualization software to model and analyze data, you also should consult Section 5.2

### 5.1 What Are Data Visualization Tools?

In this handbook, data visualization tools are any graphic representations that communicate environmental information. Presenting data in a visual format enhances your audience's understanding of and interest in the data. Data visualization tools discussed below include maps, color coding, icons, graphs, and Geographic Information Systems (GIS).

- **Maps.** Maps are one of the most basic and familiar data visualization tools used to communicate timely environmental information. If kept simple (e.g., clutter-free) and a good key explaining the different map symbols is provided, maps are one of the easiest data interpretation and visualization tools to develop and use.
- **Color coding.** Like maps, color coding is a data visualization tool that is already familiar to many people, and thus its message can be easily understood. The use of color coding to indicate “good” or “poor” environmental conditions (and ranges between those extremes) has been combined successfully with maps, graphs, indexes, icons, and other tools for risk communication. Appropriate choices of colors (and ranges of colors) enhance a viewer's understanding. For example, using well-known color coding schemes, such as green to represent “go” (i.e., it is safe to swim in a particular beach based on water quality conditions) and red to represent “stop” (i.e., do not swim in this beach today because of poor water quality conditions) is recommended.
- **Icons.** The term “icon” is used here in a very general sense to describe any visual cue or image used to communicate information—anything from a physical placard (e.g., a beach closure symbol or sign) to a symbol on a computer screen. Although words may be added, an icon ideally should be able to convey at least its basic meaning without relying on language.

- **Graphs.** Graphs are another commonly used and relatively easy-to-understand data visualization tool. They are often used to convey information about how several variables are related or compare. Some projects allow users to generate graphs as needed by specifying which variables they want plotted and how they would like them plotted.
- **Geographic Information Systems (GIS).** GIS are effective data visualization tools for displaying, analyzing, and modeling spatial or geographic information. GIS maps, animations, and two- and three-dimensional models can be generated after the detailed data are input into the system by skilled staff, which can be labor-intensive and fairly expensive. Two key advantages of GIS are the ability to quickly overlay and view several different data layers simultaneously, such as open space lands, water resources, and population, and to view and compare different future scenarios (e.g., future land uses) and their possible impacts (e.g., on environmental resources).

By applying these tools to water quality data, you can help your community's residents gain a better understanding of factors affecting water quality in area rivers and streams. Once you begin using data visualization tools, you will immediately be impressed with their ability to model and analyze your data for a variety of purposes, from making resource management decisions to supporting public outreach and education efforts.

## **5.2 Data Visualization Tools Employed In the River Index Project**

On the home page of its Web site (see Figure 15), the River Index Project displays a schematic map of the Miami River Valley, centered on the city of Dayton, Ohio. The purpose of this map is to provide an “at-a-glance” summary of water quality for all the rivers covered by the project. The most prominent features of the map are the area's rivers and streams, colored in light blue. The name of each river is written on the map. The background color of each river's label changes to match the river's current index—a key on the map reminds the viewer of what each color means. The map also displays the boundaries of the Lower Great Miami River Watershed and of local counties. In addition, the home page has an image of the River Index's “happy fish” that the River Index Project Team created to provide the public with an easily recognizable mascot for the River Index.

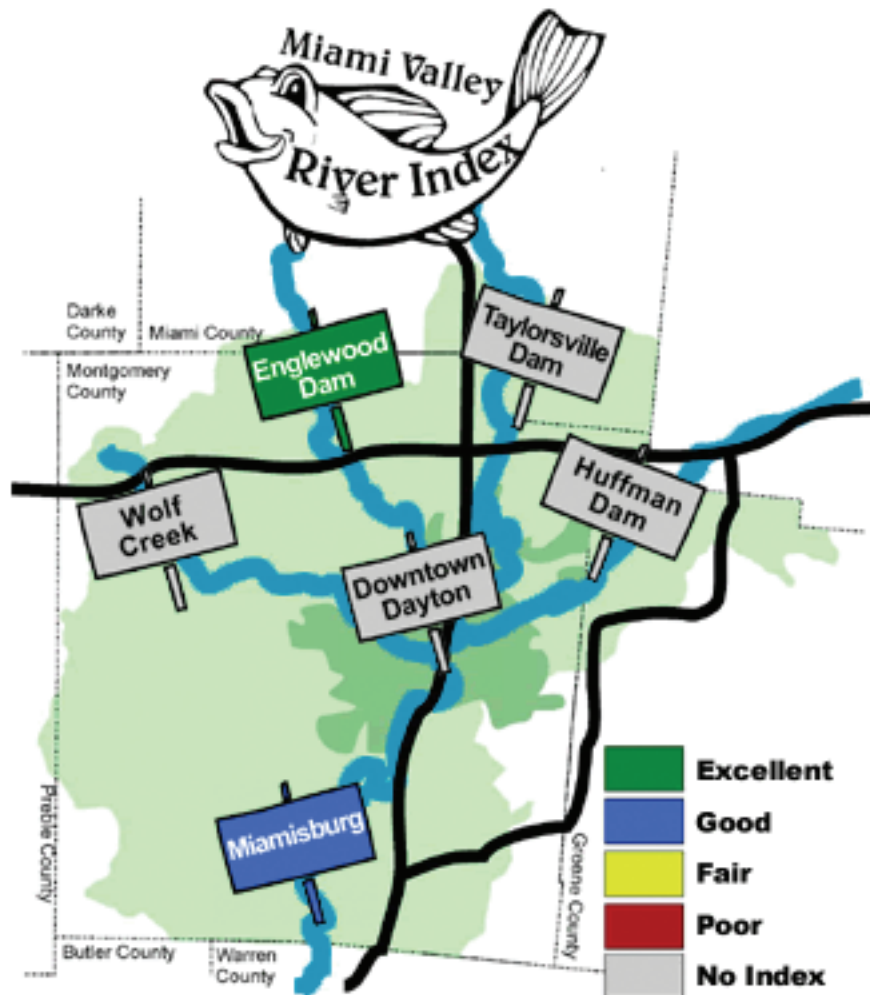


Figure 15. Home page for the River Index Project Web site

### Color-Coded Index Ratings

Each of the river index ratings is paired with a color. The color scheme chosen by the River Index Project Team and the cultural significance of each color are presented below. The color scheme amplifies and coincides with the explanatory text for each rating. This is particularly important because some people might not bother reading or thinking about the carefully-crafted text that explains each rating. They may simply note the color of the rating and make their conclusions about the river based on their intuitive understanding of that color. Other people might actually read the explanatory language but be confused about its practical significance (e.g., the difference between “favorable” and “highly favorable conditions”). Colors with a known cultural significance help to communicate the level of risk reflected by the different ratings.

## Color-Coding System Used in the River Index Project

Rating	Color	Cultural Significance of Color
Excellent	Green	In traffic signals, the green light says “go ahead.” Similarly, this rating actively entices the index user to “go ahead” and use the river for recreation. Green also connotes environmental well-being. It suggests that not only is the river good for recreation, but it is ecologically healthy.
Good	Blue	Unlike the other three colors, blue is not used in traffic signals. “Good” lacks, therefore, the direct impact of the other ratings possess. In aesthetic terms, however, it is widely accepted as the normal color of water. Even though “good” is not the best possible rating, the color blue reassures the user that the water is still clean and safe.
Fair	Yellow	Yellow is the caution light in traffic signals. Without forbidding passage, it exhorts the viewer to exercise discretion and maintain a heightened state of awareness. Similarly, a yellow rating encourages the user to think twice about his or her plans for using the river. The color encourages the user to learn more about the specific nature of the river's problems
Poor	Red	In traffic, the color red commands the viewer to stop. In an environmental context, it also conveys an impression of danger, emergency, and authority. The color red anchors “poor” at the bottom of the ranking system, and indicates that there is, at present, a serious problem with the river. The color encourages users to avoid the river until the situation improves.

### “Dial” Displays of River Index

Before the widespread use of digital readouts, scientific instruments typically presented their readings by means of analog dials. In automobiles, these dials remain the principal technology for communicating real-time information (e.g., speed, RPMs, oil pressure) to the driver. Thus, for many people the idea of reading a value off a dial is quite intuitive.

In the River Index Project, each dial has four sections, one for each of the four ratings. The needle of the dial always points squarely in the middle section of the dial. The sections of the dial are labeled (poor, fair, good, excellent) but only the one that the needle is pointing to is illuminated. These dials do not represent continuous variation in index values. Because the needle simply “jumps” from one state to the next, the dial does not distinguish between a “good” rating that is very close to “fair” and one that is very close to “excellent.” An interested user can make this distinction by looking at the total numerical score for the index.

